

AEROLOGICAL OBSERVATIONS

By RICHMOND T. ZOCH

Free-air temperatures were mostly above normal at Broken Arrow, Due West, Groesbeck, and Royal Center. At Ellendale the free-air temperatures were below normal at all levels. (See Table 1.)

Free-air relative humidities were above normal at Due West and in the upper levels at Broken Arrow, Ellendale, and Royal Center. Elsewhere they were mostly below normal.

Free-air vapor pressures were mostly above normal at Broken Arrow and Due West and in the lower levels at Groesbeck and in the upper levels at Royal Center. At Ellendale and in the upper levels at Groesbeck and in the lower levels at Royal Center they were mostly below normal.

The total precipitation for the month was below normal at Ellendale but was close to normal at the other stations.

The resultant winds were variable at the surface. (See Table 3.) At the 1,000-meter level they were southerly over the southern part of the country and westerly over the northern part. The resultants gradually changed to westerly at the 4,000-meter level with two exceptions. Over Florida they remained southerly. Over eastern Texas they were easterly, exactly opposite to the resultant winds over Oklahoma.

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during September, 1930

TEMPERATURE (°C.)

Altitude (meters) m. s. l.	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal
Surface.....	23.2	0.0	23.6	+0.3	12.4	-2.0	24.4	+0.3	19.6	-0.6
500.....	22.6	+1.0	21.9	+1.1	12.4	-2.0	22.5	+0.3	18.2	0.0
1,000.....	20.8	+1.6	19.4	+1.2	11.7	-1.2	20.3	+0.6	15.6	+0.4
1,500.....	18.4	+1.6	16.2	+0.6	9.5	-1.4	18.1	+0.7	12.7	+0.4
2,000.....	15.7	+1.5	13.3	+0.3	7.3	-1.1	15.0	0.0	10.2	+0.5
2,500.....	12.4	+1.0	10.6	+0.4	4.8	-0.7	12.8	+0.2	7.4	+0.4
3,000.....	9.3	+0.8	7.8	+0.3	2.0	-0.5	10.4	+0.3	4.4	-0.2
4,000.....	3.1	+0.7	1.8	-0.6	-4.2	-1.2	6.4	+1.7	-3.4	-2.9
5,000.....					-9.4	-0.8				

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during September, 1930—Continued

RELATIVE HUMIDITY (%)

Altitude (meters) m. s. l.	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal	Mean	De- parture from normal
Surface.....	68	0	79	+9	66	-2	79	+3	70	+2
500.....	65	-1	78	+6	65	-1	76	0	64	-3
1,000.....	59	-4	74	+3	58	-2	67	-4	58	-8
1,500.....	54	-6	75	+3	57	+2	56	-9	59	-5
2,000.....	49	-6	72	+3	54	+2	55	-5	62	+3
2,500.....	51	0	67	+1	54	+2	44	-10	60	+4
3,000.....	52	+4	66	+3	54	+3	42	-8	59	+7
4,000.....	60	+13	64	+4	56	+10	7	-36	71	+26
5,000.....					54	+12				

VAPOR PRESSURE (mb.)

Surface.....	19.32	-0.09	23.02	+3.04	10.10	-1.25	24.32	+1.52	16.55	+0.23
500.....	18.14	+0.79	20.60	+2.82	9.98	-1.12	21.27	0.97	14.24	-0.19
1,000.....	14.80	+0.45	16.90	+1.82	8.29	-0.50	16.34	0.13	11.24	-0.77
1,500.....	11.70	+0.06	14.12	+1.18	7.08	-0.20	11.88	-0.80	9.32	-0.41
2,000.....	9.06	+0.16	11.22	+0.70	5.83	-0.06	9.46	-0.41	7.41	-0.17
2,500.....	7.48	+0.81	8.71	+0.21	4.91	0.00	6.54	-1.00	5.91	+0.03
3,000.....	6.20	+1.19	7.12	+0.05	4.09	-0.03	5.29	-0.60	4.91	+0.46
4,000.....	5.18	+2.21	5.28	-0.26	2.71	+0.03			3.13	+0.76
5,000.....					1.63	+0.04				

TABLE 2.—Free-air data obtained at naval air stations during September, 1930

Altitude (meters) m. s. l.	TEMPERATURE (°C)					RELATIVE HUMIDITY (%)				
	Hamp- ton Roads, Va.	Pensa- cola, Fla.	San Diego, Calif.	Seat- tle, Wash.	Wash- ington, D. C.	Hamp- ton Roads, Va.	Pensa- cola, Fla.	San Diego, Calif.	Seat- tle, Wash.	Wash- ington D. C.
Surface.....	24.0	25.6	20.9	16.6	20.9	74	88	67	68	74
500.....	22.1	23.4	17.0	13.0	19.9	66	86	74	74	64
1,000.....	19.7	20.8	17.1	9.3	18.6	60	81	57	71	54
2,000.....	13.6	14.9	15.4	4.4	13.2	63	77	31	58	60
3,000.....	8.1	9.4	12.2	0.6	8.2	55	72	25	50	54
4,000.....		2.2		-4.7	2.0		73		54	52
5,000.....		-3.8		-11.2			63		55	

TABLE 3.—Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during September, 1930

Altitude (meters) m. s. l.	Broken Arrow, Okla. (233 meters)		Burlington, Vt. (182 meters)		Cheyenne, Wyo. (1,573 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (139 meters)		Havre, Mont. (762 meters)		Jacksonville, Fla. (65 meters)		Key West, Fla. (11 meters)		Los Angeles, Calif. (145 meters)		Spokane, Wash. (606 meters)		Modena, Utah (1,665 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Surface.....	S 5 E	1.7	S 12 W	1.8	N 83 W	2.5	N 34 E	0.4	N 54 W	1.7	S 37 E	0.6	S 82 W	0.7	S 27 E	1.2	S 51 E	3.3	N 41 W	0.9	S 5 E	7.6	S 80 W	2.4
500.....	S 27 W	6.4	S 55 W	4.0			S 87 W	1.6	N 79 W	2.0	S 2 E	4.9	S 10 E	4.3	S 10 E	4.3	S 52 E	6.5	S 66 E	1.9				
1,000.....	S 48 W	8.2	N 85 W	6.1			S 78 W	3.2	N 77 W	3.7	S 1 E	3.4	S 80 W	3.3	S 2 W	4.0	S 46 E	6.3	S 31 E	1.3	S 16 W	1.2		
1,500.....	S 53 W	6.5	N 78 W	9.1			S 69 W	2.4	N 71 W	5.8	S 54 E	1.6	N 77 W	5.3	S 2 W	3.8	S 43 E	4.8	S 40 W	0.6	N 85 W	1.7		
2,000.....	S 73 W	4.7	N 74 W	12.2			S 66 W	2.7	N 74 W	7.0	N 68 E	1.7	N 75 W	6.0	S 8 W	3.5	S 33 E	4.6	S 58 W	2.6	S 78 W	2.8	S 13 W	2.2
2,500.....	S 87 W	4.5	N 82 W	14.2			S 76 W	2.9	N 69 W	9.0	N 61 E	3.9	N 81 W	5.8	S 3 W	3.3	S 30 E	4.6	S 61 W	4.8	S 74 W	3.9	S 13 W	5.9
3,000.....	N 76 W	4.0	N 71 W	15.1			S 65 W	3.2	N 67 W	9.6	N 58 E	4.4	N 89 W	5.7	S 23 W	4.0	S 19 E	3.5	S 49 W	6.0	S 79 W	4.5	S 28 W	6.7
4,000.....	N 58 W	3.5					S 76 W	3.3	N 66 W	13.6	N 19 E	4.7	N 83 W	3.7	S 30 W	4.2	S 3 W	2.5			N 71 W	3.3	S 42 W	7.1
5,000.....	N 62 W	4.3					S 68 W	4.9	N 77 W	11.6					S 39 W	4.5	S 52 E	1.4					S 45 W	8.0

TABLE 3.—Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during September, 1930—Continued

Altitude (meters) m. s. l.	Medford, Oreg. (410 meters)		Memphis, Tenn. (145 meters)		New Orleans, La. (25 meters)		Omaha, Nebr. (321 meters)		Royal Cen- ter, Ind. (225 meters)		Salt Lake City, Utah (1,294 meters)		San Fran- cisco, Calif. (1.7 meters)		Saulte Ste. Marie, Mich. (198 meters)		Seattle, Wash. (14 meters)		Washing- ton, D. C. (10 meters)		Phoenix, Ariz. (356 meters)		Browns- ville, Tex. (12 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Surface.	S 79 W	1.2	S 2 E	1.4	N 59 E	0.8	N 65 E	0.3	S 19 E	1.3	S 30 E	3.7	N 83 W	2.4	N 80 W	0.8	S 4 W	0.8	S 37 W	0.4	S 68 E	3.6	S 21 E	1.5
500.	N 86 W	0.6	S 36 W	4.9	S 43 E	1.8	S 3 E	1.4	S 35 W	3.2	S 78 W	2.1	N 78 W	2.1	N 88 W	4.1	N 89 W	1.5	N 77 W	2.5	S 64 E	4.4	S 5 E	3.8
1,000.	N 88 W	0.8	S 64 W	4.1	S 12 E	2.8	S 56 W	4.4	S 78 W	4.4	S 19 E	4.6	N 61 W	2.4	N 87 W	7.8	N 43 W	2.1	N 77 W	2.5	S 64 E	4.4	S 5 E	3.8
1,500.	S 80 E	0.6	S 74 W	2.9	S 6 E	3.6	S 74 W	5.9	S 83 W	6.7	S 19 E	4.6	N 1 E	2.0	N 79 W	9.1	N 37 W	2.1	N 83 W	2.5	S 27 W	2.2	S 5 E	3.8
2,000.	S 63 E	0.7	N 63 W	1.9	S 7 E	3.6	S 88 W	7.6	N 86 W	8.8	S 3 W	4.2	N 16 E	1.7	N 79 W	9.5	N 1 E	1.0	N 87 W	2.5	S 22 W	2.2	S 5 E	3.8
2,500.	S 46 W	0.7	N 76 W	1.9	S 11 W	2.7	N 83 W	8.1	N 78 W	10.6	S 33 W	3.9	N 12 E	2.2	N 71 W	11.4	N 1 E	1.0	N 86 W	10.3	S 24 W	4.9	S 5 E	3.8
3,000.	S 19 W	1.8	N 57 W	2.0	S 34 W	1.6	N 76 W	9.7	N 84 W	10.4	S 57 W	4.8	N 17 W	2.2	N 65 W	12.7	N 1 E	1.0	N 87 W	10.2	S 23 W	6.4	S 5 E	3.8
4,000.	S 70 W	2.4	N 57 W	2.0	S 81 W	2.0	N 66 W	7.6	N 75 W	9.1	S 67 W	6.2	N 38 W	2.2	N 86 W	5.4	N 1 E	1.0	N 89 W	12.6	S 23 W	6.4	S 5 E	3.8
5,000.					N 85 W	2.4					S 73 W	6.9	N 86 W	5.4									S 5 W	1.2

TABLE 4.—Observations by means of kites, captive and limited-height sounding balloons during September, 1930

	Broken Arrow, Okla.	Due West, S. C.	Ellen- dale, N. Dak.	Groes- beck, Tex.	Royal Center, Ind.
Mean altitudes (meters), m. s. l., reached during month	2,721	2,937	3,296	2,507	2,653
Maximum altitude (meters), m. s. l., reached and date	4,141	4,264	8,394	4,024	4,580
Number of flights made	29	28	31	21	29
Number of days on which flights were made	29	28	30	20	26

¹ 15th. ² 15th. ³ 29th.; limited-height sounding balloon observation. ⁴ 23d. ⁵ 5th.
In addition to the above there were approximately 130 pilot balloon observations made daily at 56 Weather Bureau stations in the United States.

WEATHER IN THE UNITED STATES

THE WEATHER ELEMENTS

By M. C. BENNETT

GENERAL SUMMARY

September was warmer than normal throughout the eastern half of the country, especially from the Carolinas to the New England States where the monthly means were from 4° to 8° above the normal, while they were near the normal in most sections from the Rocky Mountains westward; however, freezing weather occurred in the Northwest during the latter part of the month.

The droughty conditions that had prevailed in most sections were relieved early in the month over much of the Great Plains and the Ohio Valley, and toward the middle of the month throughout most sections from the Rocky to the Appalachian Mountains, although the upper Mississippi Valley and other north central areas continued dry, and the drought continued in the Middle Atlantic area. The latter part of the month brought additional rainfall in most sections except over much of the area from northern North Carolina to southern Pennsylvania, where the severe drought continued.

TEMPERATURE

The noteworthy tendency to abnormally high temperatures continued, especially in the northeastern portion. Since January, no month has averaged cooler than normal in the northern border strip from the Rocky Mountains to the middle of the Lake region, while in nearly every State east of the Plains at least six of the last eight months have been hotter than normal.

The first decade was mainly hot, especially in the Atlantic and Gulf States, the central valleys and the far Northwest, but was slightly cooler than normal in most of the Lake region and the north-central portion, also in many interior districts of Oregon and California. The middle decade and the first portion of the last decade

were warm in most sections, though much of the far West and portions of the Gulf States were colder than normal, at least during part of this period. The final week was cool, save in the eastern third and the central valleys; the Atlantic States had unseasonably warm weather till the 27th or 28th, when a change to cooler reached them.

The temperature of the month averaged above normal practically everywhere save in California and the southern plateau region and in most of North Dakota. From North Carolina northeastward the month was much warmer than normal, being at many places the hottest September since 1881, and at a few the hottest ever recorded.

The highest readings were noted usually during the first four days in the eastern third of the country and in the far West. In the middle portion of the country they occurred, as a rule, at various later dates, but seldom after the 18th. For the most part, previous September records, especially those made in 1881 or 1925, were not exceeded.

The lowest marks were usually reached during the final week, though in some States along the northern border they occurred before the middle of the month. There were but few States where they closely approached the previous records.

PRECIPITATION

Considerably more than half of the country received less than the normal September rainfall, yet important regions had partial or complete relief from the serious drought of earlier months. From Kansas, Missouri, and the lower Ohio Valley southeastward liberal rainfall was the rule, with considerable benefit to late crops and pasturage, particularly as the principal rains in this area occurred before the middle of the month, save near the east Gulf and south Atlantic coasts, where they were mostly very heavy, falling chiefly after the middle of the month.